NEWS SCIENCE NEWS

KOHEI MINATO'S AMAZING MAGNETIC MOTOR

by John Dodd © March 2004

A maverick inventor's breakthrough electric motor uses permanent magnets to make power—and has investors salivating...

When we first got the call from an excited colleague that he'd just seen the most amazing invention—a magnetic motor that consumed almost no electricity—we were so sceptical that we declined an invitation to go see it. If the technology was so good, we thought, how come they didn't have any customers yet?

We forgot about the invitation and the company until several months later when our friend called again.

"Okay," he said. "They've just sold 40,000 units to a major convenience store chain. Now will you see it?"

In Japan, no one pays for 40,000 convenience store cooling fans without being reasonably sure they are going to work.

The techno-maestro

The streets of east Shinjuku are littered with the tailings of the many small factories and workshops still located there—hardly one's image of the headquarters of a world-class technology company. But this is where we are first greeted outside Kohei Minato's workshop by Nobue Minato, the wife of the inventor and co-director of the family firm.

The workshop itself is like a Hollywood set of an inventor's garage. Electrical machines, wires, measuring instruments and batteries are strewn everywhere. Along the diagram-covered walls are drill presses, racks of spare coils, Perspex plating and other paraphernalia. And seated in the back, head bowed in thought, is the 58-year-old techno-maestro himself.

Minato is no newcomer to the limelight. In fact, he has been an entertainer for most of his life, making music and producing his daughter's singing career in the USA. He possesses an oversized presence, with a booming voice and a long ponytail. In short, you can easily imagine him on stage or in a convertible cruising down the coast of California—not hunched over a mass of wires and coils in Tokyo's cramped back streets.

Joining us are a middle-aged banker and his entourage from Osaka and accounting and finance consultant Yukio Funai. The banker is doing a quick review for an investment, while the rest of us just want to see if Minato's magnetic motors really work.

A prototype car air conditioner/cooler sitting on a bench looks like it would fit into a Toyota *Corolla*, and it quickly catches our attention.

Seeing is believing

Nobue then takes us through the functions and operations of each of the machines, starting off with a simple explanation of the laws of magnetism and repulsion. She demonstrates the Minato Wheel by kicking a magnet-lined rotor into action with a magnetic wand.

Looking carefully at the rotor, we see that it has over 16 magnets embedded on a slant. Apparently, to make Minato's machines work, the positioning and angle of the magnets is critical. Kicked into life, the wheel keeps spinning, proving at least that the design doesn't suffer from magnetic lock-up.

Nobue then moves us to the next device, a weighty machine connected to a tiny battery. Apparently the load on the machine is a 35-kilogram rotor, which could easily be used in a washing machine.

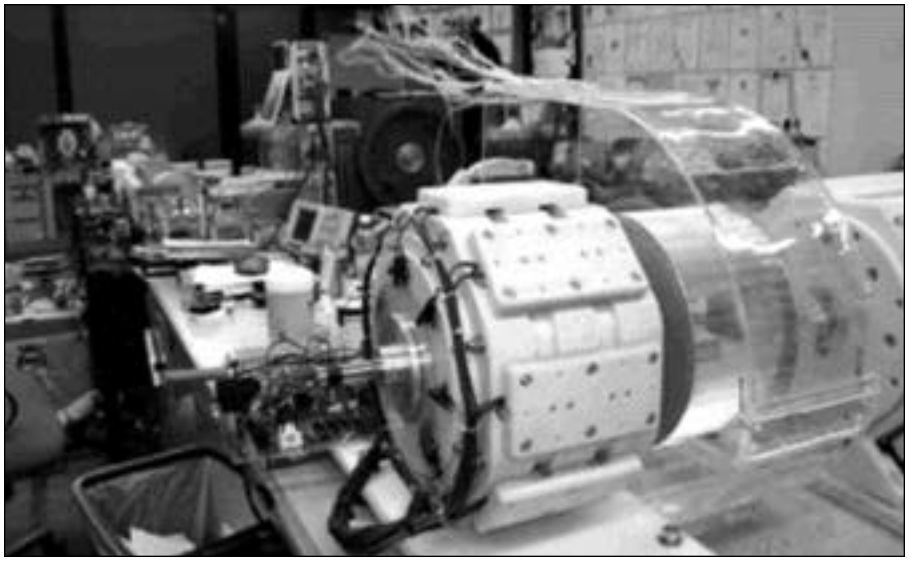
After she flicks the switch, the huge rotor spins at over 1,500 rpm effortlessly and silently. Meters show the power in and power out.

Suddenly, a power source of 16 watts or so is driving a device that should be drawing at least 200 to 300 watts.

Nobue explains to us that this and all the other devices only use electrical power for the two electromagnetic stators at either side of each rotor, which are used to kick the rotor past its lock-up point and then on to the next arc of magnets.

Apparently the angle and spacing of the magnets is such that once the rotor is moving, repulsion between the stators and the rotor poles keeps the rotor moving smoothly in a counterclockwise direction. Either way, it's impressive.

Inventor Kohei Minato stands next to one of his larger motor units which drives an industrial air conditioning fan.



Minato air conditioning unit in action.

Next we move to a unit with its motor connected to a generator. What we see is striking. The meters showed an input to the stator electromagnets of approximately 1.8 volts and 150 mA, and from the generator 9.144 volts and 192 mA output, i.e., 1.8 x 0.15 x 2 = 540 mW input and 9.144 x 0.192 = 1.755 W out.

But according to the laws of physics, you can't get more out of a device than you put into it. We mention this to Kohei Minato while looking under the workbench to make sure there aren't any hidden wires.

Minato assures us that he hasn't transcended the laws of physics. The force supplying the unexplained extra power out is generated by the magnetic strength of the permanent magnets embedded in the rotor.

"I'm simply harnessing one of the four fundamental forces of nature," he says.

Although we learned in school that magnets were always bipolar and so magnetically induced motion would always end in a locked state of equilibrium, Minato explains that he has fine-tuned the positioning of the magnets and the timing of pulses to the stators to the point where the repulsion between the rotor and the stator (the fixed outer magnetic ring) is transitory. This creates further motion, rather than a lock-up. [See last section, How it works: magnets in motion, for a full explanation.]

Kohei Minato in his workshop.

Real products

Nobue Minato leads us to the two devices that might convince a potential investor that this is all for real.

Firstly, she shows us the cooling fan prototype that is being manufactured for a convenience store chain's 14,000 outlets (three fans per outlet). The unit looks almost identical to a Mitsubishi-manufactured fan unit next to it, which is the unit currently in wide use. In a test, the airflow from both units is about the same.

The other unit is the car air conditioning prototype that caught our eye as we came in. It's a prototype for Nippon Denso, Japan's largest manufacturer of car air conditioners. The unit is remarkably compact and has the same contours and size as a conventional unit. Minato's manufacturing skills are clearly improving.

The banker and his investment

Minato has good reason to complain about Japan's social and cultural uniformity. For years, people thought of him as an oddball for playing the piano for a living, and bankers and investors have avoided him because of his habit of claiming that he'd discovered a breakthrough technology all by himself, without any formal training.

However, the Osaka banker stands up after the lecture and announces that before he goes he will commit ¥100 million to the investment pool.

Minato turns to us and smiles. We brought him good luck, and this was his third investor in as many weeks to confirm an interest.

Bringing the tech to the table

With the audience gone, we ask Minato what he plans to do to commercialise the technology. His game plan is simple and clear, he says. He wants to retain control, and he wants to commercialise the technology in Japan first—where he feels he can ensure that things get done the right way. Why doesn't he go directly to the US or China? His experiences in both countries, he suggests, have been less than successful.

"The first stage is critical in terms of creating good products and refining the technology. I don't want to be busy with legal challenges and intellectual property theft while doing that."

Still, the export and licensing of the technology are on his agenda, and Minato is talking to a variety of potential partners in other countries.

Whereas another inventor might be tempted to outsource everything to a larger corporation, Minato is driven in part by his vision of social justice and responsibility. The 40,000 motors for the convenience store chain are being produced by a group of small manufacturers in Ohta-ku and Bunkyo-ku, in the inner north of Tokyo—which is becoming a regional rust belt.

Minato is seized with the vision of reinvigorating these small workshops that until the 1980s were the bedrock of Japan's manufacturing and economic miracle. Their level of expertise will ensure that the quality of the motors will be as good as those from any major company.

International preparation

Despite his plan to do things domestically first, Minato is well prepared for the international markets. He is armed with six years of living and doing business in Los Angeles in the early 1990s—and with patent protection in over 48 countries.

Minato's US experience came after playing the piano for a living for 15 years. The idea for his magnetic motor design came from a burst of inspiration while playing the piano, and he began tinkering with his invention in the mid-1970s.

But Minato decided to drop everything in 1990 to help his daughter, Hiroko, who at the age of 20 decided that she wanted to be a rhythm and blues star in the USA. Minato is a strong believer in family: if Hiroko was going to find fame and fortune in the USA, Dad had better be there to help manage her. He succeeded in helping Hiroko achieve a UK dance chart number-one hit in 1995.

In 1996, Minato returned to Japan and his magnetic motor project. The following year he displayed his prototypes to national power companies, government officials and others at a five-day conference in Mexico City. Interest was palpable, and Minato realised that his invention might meet a global need for energy-saving devices.

Subsequent previews and speeches in Korea and Singapore further consolidated his commitment to bringing the invention to fruition, and he was able to bring in several early-stage investors.

During the late 1990s, Minato continued to refine his prototypes. He also stayed in constant contact with his lawyer, registering patents in major countries around the world. Through his experiences in the US he realised that legal protection was critical, even if it meant delaying release of the technology by a couple of years.

Ironically, by the time he'd won patents in 47 countries, the Japanese Patent Office turned him down on the grounds that the invention "couldn't possibly work" and that somehow he was fabricating the claims. But a few months later it was forced to recant its decision after the US Patent Office recognised his invention and gave him the first of two patents (see USPatent #5,394,289).

Minato noted: "How typical of Japan's small-minded bureaucrats that they needed the leadership of the US to accept that my invention was genuine."

By 2001, the Minatos had refined their motors and met enough potential investors to enter into a major international relationship initially with a Saudi company, to be followed thereafter by companies in the US and elsewhere. However, fate dealt the investors and Minato's business a serious blow when the World Trade Center was attacked in New York City. The Saudis retreated, and Minato's plans fell back to square one.

Now Minato is once again ready to move. With the first order in the works and more orders pending successful prototypes, he has decided that investors don't have to be primary partners. He is actively accepting inquiries from corporate investors who can bring strategic advantages and corporate credibility with them.

The Minatos' company, Japan Magnetic Fan, is planning to make a series of investment tie-up announcements in the first and second quarters of 2004.

Implications of the technology

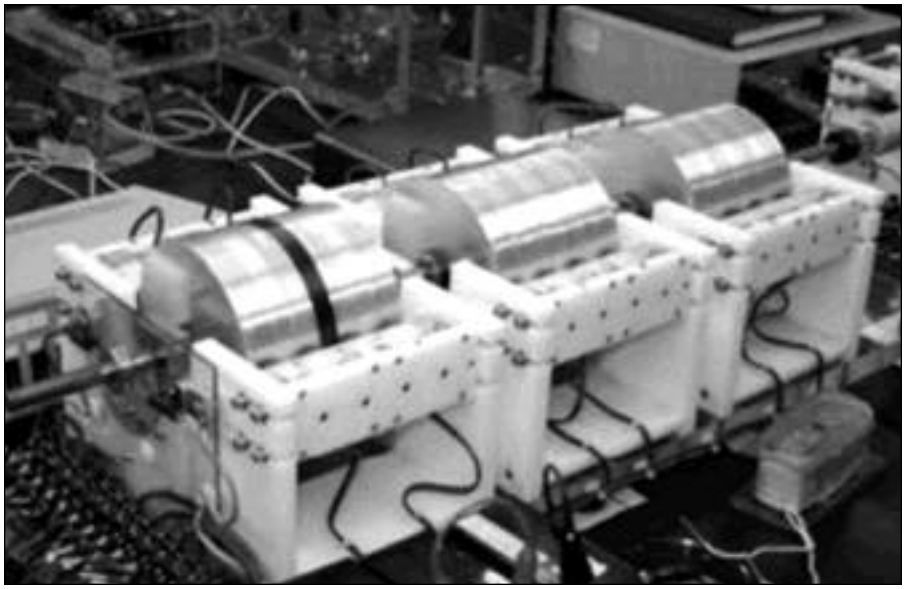
Minato's motors consume just 20 per cent or less of the power of conventional motors with the same torque and horsepower. They run cool to the touch and produce almost no acoustic or electrical noise. They are significantly safer and cheaper (in terms of power consumed), and they are sounder environmentally.

The implications are enormous. In the USA alone, almost 55 per cent of the nation's electricity is consumed by electric motors.

While most factory operators buy the cheapest motors possible, they are steadily being educated by bodies like NEMA (National Electrical Manufacturers Association) that the costs of running a motor over a typical 20-year lifespan comprise a purchase price of just 3 per cent of the total and electricity costs of 97 per cent. It is not unusual for a US$2,000 motor to consume $80,000 of electricity (at a price of 0.06 cents per kilowatt hour).

Since 1992, when efficiency legislation was put into place at the US federal level, motor efficiency has been a high priority—and motors saving 20 per cent or so on electrical bills are considered highly efficient.

Minato is about to introduce a motor which saves 80 per cent, putting it into an entirely new class. The $80,000 running cost will drop to just $16,000. This is a significant saving, particularly when multiplied by the millions of motors used throughout the USA and Japan—and the world.



Two ganged motors connected to a generator, for use in the home.

Efficiency of the Minato motors

Minato's invention and its ability to use remarkably less power and run without heat or noise makes it perfect for home appliances, personal computers, cellphones (a miniature generator is in the works) and other consumer products.

The magnetic motor will be cheaper to make than a standard motor, as the rotor and stator assemblies can be set into plastic housings due to the fact that the system creates very little heat.

Further, with the motor's energy efficiency, it will be well suited for any application where a motor has limited energy to drive it. While development is still focused on replacing existing devices, Minato says that his motor has sufficient torque to power a vehicle.

With the help of magnetic propulsion, it is feasible to attach a generator to the motor and produce more electric power than is put into the device. Minato says that average efficiency of his motors is about 330 per cent.

Mention of "over-unity" devices in many scientific circles will draw icy scepticism. But if you can accept the idea that Minato's device is able to create motion and torque through its unique, sustainable, permanent magnet propulsion system, then it makes sense that more can be got out of the unit than is put into it in terms of electrical power. Indeed, if the device can produce a surplus of power for longer periods, every household in the land will want one.

"I am not in this for the money," Minato said. "I have done well in my musical career, but I want to make a contribution to society—helping the back-street manufacturers here in Japan and elsewhere. I want to reverse the trends caused by major multinationals. There is a place for corporations. But as the oil industry has taught us, energy is one area where a breakthrough invention like this cannot be entrusted to large companies."

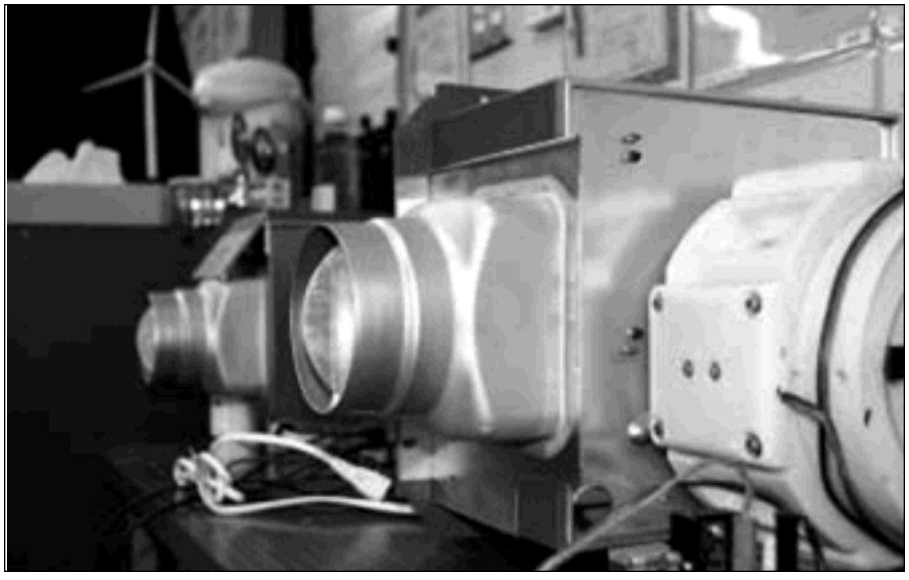
Minato was once close to making a deal with Enron. But today he is firmly on a mission to support the small and the independent—and to go worldwide with them and his amazing machine. "Our plan is to rally smaller companies and pool their talent, and one day to produce the technology across a wide range of fields."

How it works: magnets in motion

Minato's Magnetic Motor is quite different from the four fundamental types of motors manufactured today. The most modern designs, be they AC or DC, servo or stepper, all fundamentally employ the same principle of electromagnetic force of attraction that was discovered almost 200 years ago. Their designs all suffer significant losses in efficiency caused by the coils, the core and consequent magnetic losses (eddy currents). These losses are typically given up as heat from the system.

Minato's magnetic motor uses magnetic repulsion as its core source of energy and suffers very few losses. It creates almost no heat and is substantially more efficient (up to 330 per cent) than conventional motors.

Most of Minato's test units consist of a three-layered, non-magnetic rotor fitted with powerful Sumitomo Neomax (neodymium-iron-boron) magnets located (for a duration of five degrees) every 175 degrees around the circumference of the rotor. The magnets possess a powerful force of 5,000 gauss and repulsively interact with the two diametrically opposed fixed electromagnetic stators.



Another air conditioning unit developed by Kohei Minato.

The rotor moves due to the stator electromagnets bouncing the rotor magnets away from the stators, in the direction to which the rotor magnets are inclined. The stator electromagnets are pulsed at specific intervals and durations (about 10 milliseconds at start-up, and reducing in period to 2 ms as the rotor reaches its natural speed), to make sure that they are only energised when facing a departing rotor magnet.

Minato overcame a number of obstacles that have stopped other inventors from realising a magnetic motor earlier (although there have been a lot of attempts).

The first is that the rotor magnets use repulsion and not attraction to reduce the amount of energy needed. Secondly, the positioning and angle of the magnets on the rotor are critical to providing the right "glancing" motion of rotor and stator fields, bouncing off each other to create repulsive (and thus motive) force. Also, the magnets have to be powerful—something that only became possible after neodymium magnets appeared in the 1980s.

The north-south structure of any magnet can be maintained by making the rotor with three layers: a top layer with the north pole of the Neomax magnets facing outwards, a nonmagnetic layer and a south pole outward-facing layer. These layers are aligned with the opposing north-south poles of the two electromagnets. The pulse timing on the electromagnets is the key to creating a "sweet spot" for the repulsion between rotor and stator.

Timing is created by means of sensors picking up timing marks just before the rotor magnets appear. The rotor is started and stopped by applying and removing energy to the two stator electromagnets. After a deceleration period, the rotor aligns with the magnets facing the iron cores of the stator electromagnets. ∞

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